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REC'D 25 JUL 2000

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THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME;

UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

May 24, 2000

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM
THE RECORDS OF THE UNITED STATES PATENT AND TRADEMARK
OFFICE OF THOSE PAPERS OF THE BELOW IDENTIFIED PATENT
APPLICATION THAT MET THE REQUIREMENTS TO BE GRANTED A
FILING DATE UNDER 35 USC 111.

APPLICATION NUMBER: 09/306,017

FILING DATE: May 06, 1999

PRIORITY DOCUMENT

SUBMITTED OR TRANSMITTED IN
COMPLIANCE WITH RULE 17.1(a) OR (b)



By Authority of the
COMMISSIONER OF PATENTS AND TRADEMARKS

L. Edelen

L. EDELEN
Certifying Officer

UTILITY PATENT APPLICATION TRANSMITTAL (Small Entity)

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No.
6321-1ATotal Pages in this Submission
323

TO THE ASSISTANT COMMISSIONER FOR PATENTS

Box Patent Application
Washington, D.C. 20231

Transmitted herewith for filing under 35 U.S.C. 111(a) and 37 C.F.R. 1.53(b) is a new utility patent application for an invention entitled:

Liquid Mist Fire Extinguisher

and invented by:

Gordon Duane Hopkins

If a CONTINUATION APPLICATION, check appropriate box and supply the requisite information:

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No.: _____

Which is a:

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Enclosed are:

Application Elements

1. ☒ Filing fee as calculated and transmitted as described below
2. ☒ Specification having 11 pages and including the following:
 - a. ☒ Descriptive Title of the Invention
 - b. ☐ Cross References to Related Applications (if applicable)
 - c. ☐ Statement Regarding Federally-sponsored Research/Development (if applicable)
 - d. ☐ Reference to Microfiche Appendix (if applicable)
 - e. ☒ Background of the Invention
 - f. ☒ Brief Summary of the Invention
 - g. ☒ Brief Description of the Drawings (if drawings filed)
 - h. ☒ Detailed Description
 - i. ☒ Claim(s) as Classified Below
 - j. ☒ Abstract of the Disclosure

**UTILITY PATENT APPLICATION TRANSMITTAL
(Small Entity)**

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No.
6321-1A

Total Pages in this Submission
323

Application Elements (Continued)

3. ☒ Drawing(s) *(when necessary as prescribed by 35 USC 113)*
a. ☐ Formal b. ☒ Informal Number of Sheets 6
4. ☒ Oath or Declaration
a. ☒ Newly executed *(original or copy)* ☐ Unexecuted
b. ☐ Copy from a prior application (37 CFR 1.63(d)) *(for continuation/divisional application only)*
c. ☒ With Power of Attorney ☐ Without Power of Attorney
d. ☐ DELETION OF INVENTOR(S)
Signed statement attached deleting inventor(s) named in the prior application,
see 37 C.F.R. 1.63(d)(2) and 1.33(b).
5. ☐ Incorporation By Reference *(usable if Box 4b is checked)*
The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied
under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby
incorporated by reference therein.
6. ☐ Computer Program in Microfiche
7. ☐ Genetic Sequence Submission *(if applicable, all must be included)*
a. ☐ Paper Copy
b. ☐ Computer Readable Copy
c. ☐ Statement Verifying Identical Paper and Computer Readable Copy

Accompanying Application Parts

8. ☒ Assignment Papers *(cover sheet & documents)*
9. ☐ 37 CFR 3.73(b) Statement *(when there is an assignee)*
10. ☐ English Translation Document *(if applicable)*
11. ☒ Information Disclosure Statement/PTO-1449 ☒ Copies of IDS Citations
12. ☐ Preliminary Amendment
13. ☒ Acknowledgment postcard
14. ☐ Certificate of Mailing
☐ First Class ☐ Express Mail *(Specify Label No.):* _____

**UTILITY PATENT APPLICATION TRANSMITTAL
(Small Entity)**

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No.
6321-1A

Total Pages in this Submission
323

Accompanying Application Parts (Continued)

15. ☐ Certified Copy of Priority Document(s) (if foreign priority is claimed)
16. ☒ Small Entity Statement(s) - Specify Number of Statements Submitted: 1
17. ☐ Additional Enclosures (please identify below):

Fee Calculation and Transmittal

CLAIMS AS FILED

For	#Filed	#Allowed	#Extra	Rate	Fee
Total Claims	22	- 20 =	2	x \$9.00	\$18.00
Indep. Claims	3	- 3 =	0	x \$39.00	\$0.00
Multiple Dependent Claims (check if applicable) <input type="checkbox"/>					\$0.00
BASIC FEE					\$380.00
OTHER FEE (specify purpose) <u>Assignment Registration</u>					\$40.00
TOTAL FILING FEE					\$438.00

- ☒ A check in the amount of **\$438.00** to cover the filing fee is enclosed.
- ☒ The Commissioner is hereby authorized to charge and credit Deposit Account No. **13-0398** as described below. A duplicate copy of this sheet is enclosed.
- ☐ Charge the amount of _____ as filing fee.
 - ☒ Credit any overpayment.
 - ☒ Charge any additional filing fees required under 37 C.F.R. 1.16 and 1.17.
 - ☐ Charge the issue fee set in 37 C.F.R. 1.18 at the mailing of the Notice of Allowance, pursuant to 37 C.F.R. 1.311(b).

Dated: **May 5, 1999**


Signature

CC:

LIQUID MIST FIRE EXTINGUISHER

FIELD OF INVENTION

This invention relates to a liquid mist fire extinguisher and more particularly a low
5 pressure water atomizing fire extinguisher.

BACKGROUND TO THE INVENTION

Fires are classified as A, B, C or D as follows: Class A: ordinary combustibles; Class
B: flammable liquids; Class C: electrical fires and Class D: flammable metals. Fire
extinguishers are certified in Canada and the United States by ULC and UL
respectively according to their effectiveness in suppressing the fires of the various
classes. A standard extinguisher with an A:B:C rating for example, is effective in
suppressing A, B and C class fires.

To achieve an A:B:C rating, extinguishers to date have used either dry chemicals or
halon. The use of dry chemicals results in a messy and sometimes toxic cleanup.
Halon is a clean alternative but has been banned by the Montreal Protocol on
Substances that Deplete the Ozone Layer.

Water has also been used but prior art water extinguishers have not achieved an A:B:C
rating. The standard water extinguisher for example discharges a solid stream of water
from a pressurized canister and has a limited Class 2A rating.

Another type of known water extinguisher discharges a spray of water droplets and
utilizes the same amount of water as the standard extinguisher. This extinguisher
typically operates at about 100 psi. While this water extinguisher has been rated A:C,
it does not generate the fine atomized mist required for a class B rating.

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It is a feature of the present invention to provide an extinguisher in which water and air are stored together and released simultaneously and separately to produce a fine liquid mist, capable of class A:B:C rating.

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SUMMARY OF THE INVENTION

In accordance with the present invention, there is provided an apparatus for producing a fine liquid mist, comprising a container for holding a gas and liquid under pressure; valve means for simultaneously releasing said gas and said liquid separately from said container; feed means for feeding said gas and said liquid separately to a nozzle; said nozzle including a mixing chamber and outlet orifices for emission of said liquid mists.

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In another embodiment of the present invention, there is provided a release valve for simultaneously releasing a gas and a liquid separately from a pressurized container, comprising a first valve controlling a liquid outlet from said container; a second valve controlling a gas outlet from said container; means for feeding said liquid and said gas separately from said valves; means for actuating said valves, simultaneously.

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In a further embodiment of the present invention, there is provided a liquid mist fire extinguisher, comprising a container for holding a gas and a liquid under pressure; a valve assembly at an upper end of said container; valve means for simultaneously releasing said gas and said liquid separately from said container; a hose for feeding said gas and said liquid separately through a nozzle; said nozzle assembly including means for feeding said gas and said liquid separately through a mixing chamber, and exiting orifices in an end surface of said nozzle assembly for issue of mixed gas and liquid in a fine mist.

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BRIEF DESCRIPTION OF THE DRAWINGS

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Figure 1 is a cross-section of a fire extinguisher according to the present invention;

Figure 2 is a cross-section of the valve structure at the top of the extinguisher of Figure 1, to a larger scale, and at right angles to that of Figure 1; with valve closed;

Figure 3 is a cross section similar to that of Figure 2, with valve open;

Figure 4 is a cross section of the valve structure, on the axis of the cross section of Figure 1;

Figure 5 is a longitudinal cross section through the nozzle;

Figure 6 is an end view on the end of the nozzle member, in the direction of arrow A.

Figure 7 is a cross-section of another embodiment of the valve structure of the present invention, on the axis of the cross-section Figure 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The drawings illustrate a fire extinguisher assembly having an A,B and C rating comprising a pressure container 10 of approximately 12L capacity having at its upper end a valve structure 12, and flexible hose 14 with a relatively ridged wand portion 16, and a nozzle assembly 18 at the end of the wand 16. The valve structure 12 closes the upper end of the container which, in use contains a liquid, for example, water, and its lower portion 20 and a pressurizing gas, for example, air at its upper portion 22, the gas/liquid in the phase shown at 24. A tube 26 extends down and from the valve structure 12 towards the bottom of container, finishing a short distance above the bottom. The tube is connected at its upper end to the valve structure 12.

Considering Figures 2 and 3 specifically, the valve structure 12 comprises a main body 30, which is attached, by a fitted threaded connection 32 to a neck portion 34 at the upper part of container 10. The body 30 has a central longitudinal extending bore, having a varying dimension along its length. At its lower end 36, the bore is enlarged and receives the upper end of the tube 26, again conveniently a threaded connection. The bore is then tapered inwardly to form a valve seat 38. The bore enlarges, at 40, to form a fluid passage, described later in connection with Figure 4. Above the enlargement 40, the bore decreases in size to form a tubular valve seat at 42. Above the valve seat 42, the bore is enlarged and a plug 44 is inserted to close off the bore, and also to form a chamber which serves as a transfer passage 46, again described in

more detail with respect to Figure 4. The plug 44 has a central bore 48 and extending through the bore is a valve member 60. The valve member 60 has various portions spaced along its length for cooperation with the valve seats 38 and 42. At its lower end a tapered end valve member 62 cooperates with tapered valve seat 38, while at an intermediate position, an extended valve portion 64 cooperates with the tubular seat 42. Valve member 62 and valve seat 38 acts to control flow of liquid from container, and valve portion 64 acts with seat 42 to control flow of gas from the container.

A further bore 70 extends up through the body 30 and connects to a radial bore 72 extending to the central bore to form a port 76, between the enlargement 40 and the passage 46. The outer end of the radial bore 72 is closed by a plug 78 which can be used to provide a connection to a pressure gauge. Considering the valve portion 64, an annular recess 66 on the valve member 60 extends to connect with the passageway 46 only, in a closed position, as in Figure 2, and to connect passageway 46 with port 76, in an open position, as in Figure 3.

The upper end 80 of the valve member 60 extends beyond the plug 48. A lever 82, see Figure 1, is pivotally mounted on the end of the body 30 and extends over the outer end 80. A compression spring 81 is mounted on the outer end 80 of the valve member 60 to bias the valve member to a closed position. Pressure by the lever 82 on the outer end 80 of the valve member 60 will open the valves. Various seals are provided for the valve member 60. An O-ring 84 is provided between the passage 46 and the upper end surface of the body 30, in the example of the plug 48, to prevent leakage from the top end. Two further O-rings 86 and 88 are spaced apart to prevent leakage from port 76 to the passage 46 and enlargement 40 in the valve closed position, and to prevent leakage from the port 76 to the enlargement 40 in the valve open position. O-rings 100 and 102 can be provided in a conventional manner to seal threaded connections 32 and the threaded connection between the plug 44 and the upper end of the body 30.

Figure 4 illustrates the attachment of the flexible hose 14 to the valve body 30, with connections to the enlargement 40, and also connection of a flexible tube 110, inside

the hose 14 to the passage 46. The hose 14 is connected to the body 30 via a threaded connection 112 in a bore 114 connecting to the enlargement 40. The tube 110 extends up through a bore 116 in the top part of the body 30 to connect to the passage 46. As seen in Figure 1, the tube 110 extends through the hose 14 and wand 16 to a nozzle assembly 18.

When the valves are closed, neither the liquid nor gas can flow from the container 10 to the nozzle assembly 18. Pushing down on the lever 82 opens the valves to a position as seen in Figure 3. Liquid escapes up past the lower end of the valve member 60 into the enlargement 40 and up through bore 114 and connection 112 into the hose 14. Simultaneously, air escapes through bores 70 and 76, recess 66, passage 46 and then through the tube 110 to nozzle 18.

One form of nozzle assembly 18 is illustrated in Figure 5. This assembly has a nozzle member 120 attached to the end of the wand 16 and an internal member 122 to which the tube 110 is attached. The orifice formed in the internal member 122 is preferably 0.75-1.5 mm in diameter. The member 122 is connected to the nozzle member 120 and a passage 124 provides access, via a port 125, to a mixing chamber 126 for the liquid in the wand 16. Port 125 is preferably 2 - 3.5 mm in diameter. Liquid enters the mixing chamber 126 at right angles to the longitudinal axis of the nozzle 18. Gas can flow through a central bore 128 of the member 122 into the mixing chamber 126. The nozzle member 120 is circular in cross section, and has a closed end with a number of orifices 132. One arrangement is seen in Figure 6. The closed ends in face 130 are angled with respect to the longitudinal axis preferably in the range of 60° to 75°.

The gas enters the mixing chamber in a longitudinal direction and combines with the jet of liquid that is entering the mixing chamber at port 125. Thus, this will produce a gas/liquid mixture. The mixture exits the chamber through the orifices 132, resulting in further expansion and further atomization of the liquid. The orifice pattern combined with the amount of atomization and end face angles produces the described mist pattern.

To charge the container 10, about 6L of liquid, for example water is placed in the container. The gas, for example air, is fed into the upper part of the container 10 through the wand 16 by removing the nozzle 120 and replacing it with an air valve (not shown). The gas source means is connected to the air valve, the valves are opened and air is fed into the container 10. After pressurization, the nozzle is replaced. Pressurization in this manner minimizes later tampering. As an alternative, the gas is fed through bore 72 by removing plug 78. As a further alternative, a pressure gauge can be permanently mounted at the bore 72, and this can be provided with a T-shaped valved connection having an air valve for connection of a pressurized source of gas. The gas is generally pressurized initially to a maximum pressure of about 175 pounds per square inch.

Figure 7 illustrates an alternate embodiment of the valve structure 12. The central longitudinal extending bore above enlargement 40 is not enlarged eliminating the need for a plug such as plug 44 in Figure 4 to close off the bore. The bore 116 extends through the top of the valve body 30. The top of the bore 116 is closed by a plug 31. A second bore 33 serves as a transfer passage in place of the chamber 46 (see Figure 4), and is closed by plug 37. The valve structure 12 is otherwise the same as the previous embodiment including the tube 110 which extends up through bore 116.

A carrying handle can be attached through the valve structure 12 as seen in Figure 1. The container is shaped so that such can normally stand upright on a surface.

I CLAIM

1. An apparatus for producing a fine liquid mist, comprising:

a container for holding a gas and liquid under pressure;
valve means for simultaneously releasing said gas and said liquid separately from said container;
feed means for feeding said gas and said liquid separately to a nozzle;
said nozzle including a mixing chamber and outlet orifices for emission of said liquid mists.
2. A release valve for simultaneously releasing a gas and a liquid separately from a pressurized container, comprising:

a first valve controlling a liquid outlet from said container;
a second valve controlling a gas outlet from said container;
means for feeding said liquid and said gas separately from said valves;
means for actuating said valves, simultaneously.
3. A release valve according to claim 2, comprising an elongate valve member, said first valve formed at one end of said valve member, said second valve formed at a position intermediate the other end of said valve member and said first valve, said means for actuating said valves positioned at the other end of said valve member.
4. A release valve according to claim 3, further comprising an enlargement at said one end, movable axially to open and close an orifice.
5. A release valve according to claim 4, further comprising a reduced section at said intermediate position, axially spaced inlets and outlets, said reduced section movable axially to a position connecting said inlet and outlet.

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6. A release valve according to claim 5, comprising a valve body, said elongate member positioned in a bore in said valve body, said orifice formed at one end of said bore, and means for feeding said liquid from said orifice to an outlet in said bore.
7. A release valve according to claim 6, comprising means for feeding gas through said body to a port in said bore and a chamber in said body at the other end of said bore, said reduced section movable to connect and disconnect said port to said chamber and means for feeding said gas from said chamber to said outlet.
8. A release vale according to claim 7, including connection means for connecting a feed means to said outlet and feeding said liquid and said gas separately to said feed means.
9. A release valve according to claim 8, comprising means for feeding gas through said body to a port in said bore and a transfer passage in said body at a position intermediate the other end of said bore, said reduced section movable to connect and disconnect said port to said chamber and means for feeding said gas from said chamber to said outlet.
10. A release valve according to claim 9, including connection means for connecting a feed means to said outlet and feeding said liquid and said gas separately to said feed means.
11. A liquid mist fire extinguisher, comprising;
a container for holding a gas and a liquid under pressure;
a valve assembly at an upper end of said container;
valve means for simultaneously releasing said gas and said liquid separately from said container;
a hose for feeding said gas and said liquid separately through a nozzle;

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said nozzle assembly including means for feeding said gas and said liquid separately through a mixing chamber, and exiting orifices in an end surface of said nozzle assembly for issue of mixed gas and liquid in a fine mist.

12. A fire extinguisher as claimed in claim 11, including a tube within the hose for feeding said gas.
13. A fire extinguisher as claimed in claim 12, said valve means comprising a first valve controlling a liquid outlet from said container, a second valve controlling a gas outlet from said container, means for feeding said liquid and said gas separately from said valves, and means for actuating said valves simultaneously.
14. A fire extinguisher as claimed in claim 13, said first valve formed at one end of said valve member, said second valve formed at a position intermediate at the other end of said valve member and said first valve, said means for actuating the said valves simultaneously positioned at the other end of said valve member.
15. A fire extinguisher as claimed in claim 14, further comprising an enlargement at said one end, movable axially to open and close an orifice.
16. A fire extinguisher as claimed in claim 15, further comprising a reduced section at said intermediate position, axially spaced inlets and outlets, said reduced section movable axially to a position connecting said inlet and outlet.
17. A fire extinguisher as claimed in claim 16, comprising a valve body, an elongated member positioned in a bore in said body, said orifice formed at one end of said bore, and means for freeing said liquid from said orifice to an outlet in a said bore.

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18. A fire extinguisher as claimed in claim 17, comprising means of feeding gas through said body to a port in said bore and a chamber in said body at the outer end of said bore, said reduced section movable to connect and disconnect said port to said chamber and means for feeding said gas from said chamber to said outlet.
19. A fire extinguisher as claimed in claim 18, including connection means for connecting a feed means to said outlet and feeding said liquid and said gas separately to said feed means.
20. A fire extinguisher as claimed in claim 17, comprising means of feeding gas through said body to a port in said bore and a transfer passage in said body at a position intermediate the outer end of said bore, said reduced section movable to connect and disconnect said port to said chamber and means for feeding said gas from said chamber to said outlet.
21. A fire extinguisher as claimed in claim 20, including connection means for connecting a feed means to said outlet and feeding said liquid and said gas separately to said feed means.
22. A fire extinguisher according to claim 11, said nozzle comprising angled closed ends.

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ABSTRACT

A liquid mist fire extinguisher, comprising a container for holding a gas and a liquid under pressure. The extinguisher has valve assembly at the upper end of the container, a valve for simultaneously releasing said gas and said liquid separately from the container, and a hose for feeding said gas and said liquid separately through a nozzle. The nozzle assembly includes means for feeding said gas and said liquid separately through a mixing chamber, and exiting orifices in an end surface of said nozzle assembly for issue of mixed gas and liquid in a fine mist.

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Docket No.
6321-1A

Declaration and Power of Attorney For Patent Application

English Language Declaration

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

the specification of which

(check one)

☒ is attached hereto.

☐ was filed on _____ as United States Application No. or PCT International Application Number _____ and was amended on _____ (if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365(b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)

Priority Not Claimed

_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	<input type="checkbox"/>
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	<input type="checkbox"/>
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	<input type="checkbox"/>

I hereby claim the benefit under 35 U.S.C. Section 119(e) of any United States provisional application(s) listed below:

_____ (Application Serial No.)	_____ (Filing Date)
_____ (Application Serial No.)	_____ (Filing Date)
_____ (Application Serial No.)	_____ (Filing Date)

I hereby claim the benefit under 35 U. S. C. Section 120 of any United States application(s), or Section 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. Section 112, I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, C. F. R., Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

_____ (Application Serial No.)	_____ (Filing Date)	_____ (Status) (patented, pending, abandoned)
_____ (Application Serial No.)	_____ (Filing Date)	_____ (Status) (patented, pending, abandoned)
_____ (Application Serial No.)	_____ (Filing Date)	_____ (Status) (patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(list name and registration number)*

Alan Thomson, Registration No. 20,006
 Ian Fincham, Registration No. 26,375
 Adrian Zahl, Registration No. 35,774

Send Correspondence to: **Ian Fincham**
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Ian Fincham, (613) 234-1907

Full name of sole or first inventor Gordon Duane Hopkins	
Sole or first inventor's signature <i>G. Hopkins</i>	Date <i>April 30, 1999</i>
Residence Newfoundland, Canada	
Citizenship Canadian	
Post Office Address 119 Clyde Avenue, Mount Pearl, NF A1N 4R9 Canada	

Full name of second inventor, if any	
Second inventor's signature	Date
Residence	
Citizenship	
Post Office Address	

**VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY
STATUS (37 CFR 1.9(f) AND 1.27 (c)) - SMALL BUSINESS CONCERN**

Docket No.
6321-1A

Serial No.

Filing Date

Patent No.

Issu Date

Applicant/
Patentee:

Gordon Duane Hopkins

Invention:

Liquid Mist Fire Extinguisher

I hereby declare that I am:

- ☐ the owner of the small business concern identified below:
☒ an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF CONCERN: Terra Nova Marine Company LimitedADDRESS OF CONCERN: 119 Clyde Avenue, Mount Pearl, NF A1N 4R9 Canada

I hereby declare that the above-identified small business concern qualifies as a small business concern as defined in 37 CFR 1.9(d), for purposes of paying reduced fees under Section 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the above identified invention described in:

- ☒ the specification filed herewith with title as listed above.
☐ the application identified above.
☐ the patent identified above.

If the rights held by the above-identified small business concern are not exclusive, each individual, concern or organization having rights to the invention is listed on the next page and no rights to the invention are held by any person, other than the inventor, who could not qualify as an independent inventor under 37 CFR 1.9(c) or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

- ☒ no such person, concern or organization exists.
☐ each such person, concern or organization is listed below.

FULL NAME	<hr/>		
ADDRESS	<hr/>		
	<input type="checkbox"/> Individual	<input type="checkbox"/> Small Business Concern	<input type="checkbox"/> Nonprofit Organization
FULL NAME	<hr/>		
ADDRESS	<hr/>		
	<input type="checkbox"/> Individual	<input type="checkbox"/> Small Business Concern	<input type="checkbox"/> Nonprofit Organization
FULL NAME	<hr/>		
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	<input type="checkbox"/> Individual	<input type="checkbox"/> Small Business Concern	<input type="checkbox"/> Nonprofit Organization
FULL NAME	<hr/>		
ADDRESS	<hr/>		
	<input type="checkbox"/> Individual	<input type="checkbox"/> Small Business Concern	<input type="checkbox"/> Nonprofit Organization

Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING: Stephen Whitten
 TITLE OF PERSON SIGNING: _____
 OTHER THAN OWNER: General Manager
 ADDRESS OF PERSON SIGNING: c/o 119 Clyde Avenue, Mount Pearl, NF
A1N 4R9 Canada

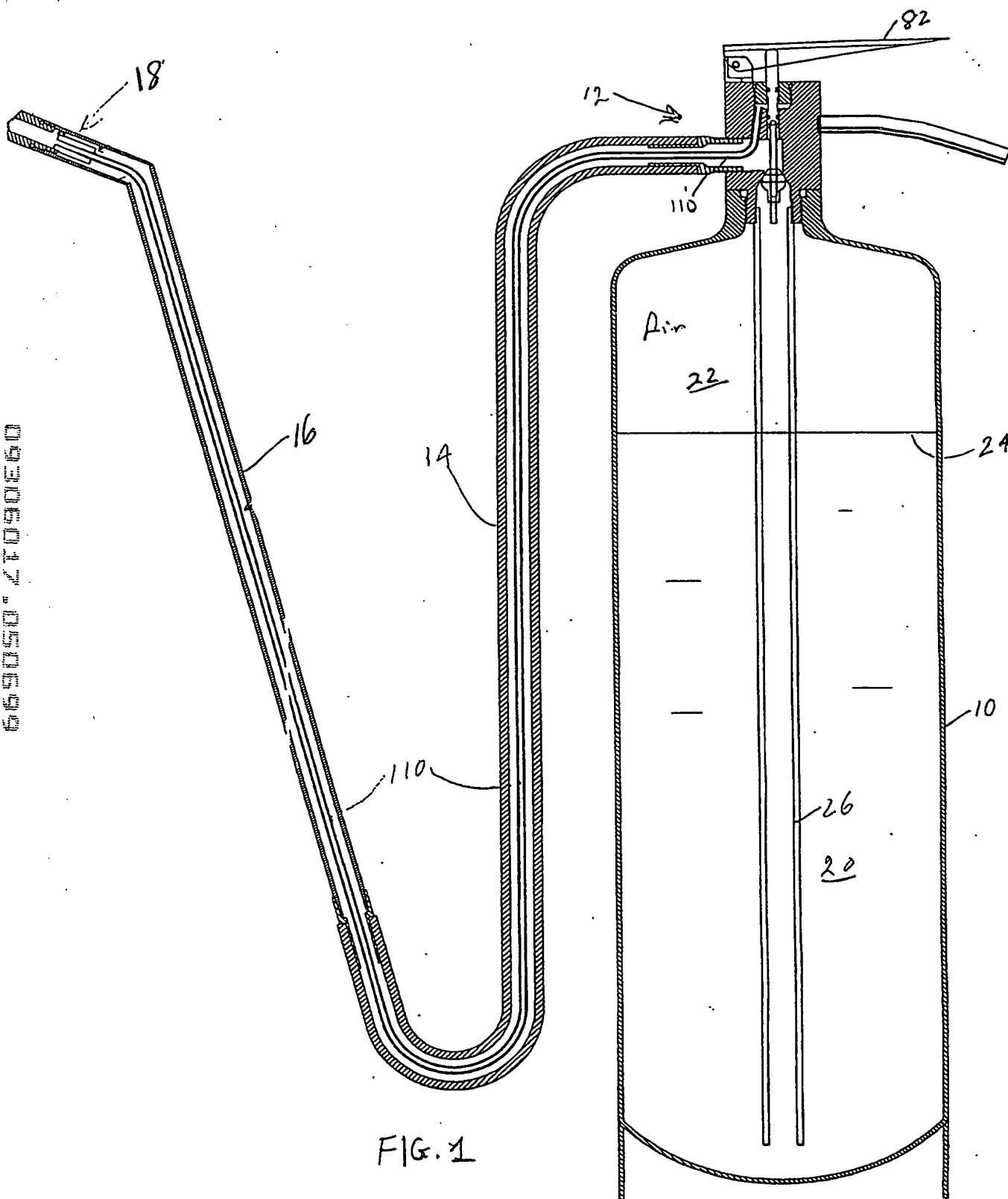
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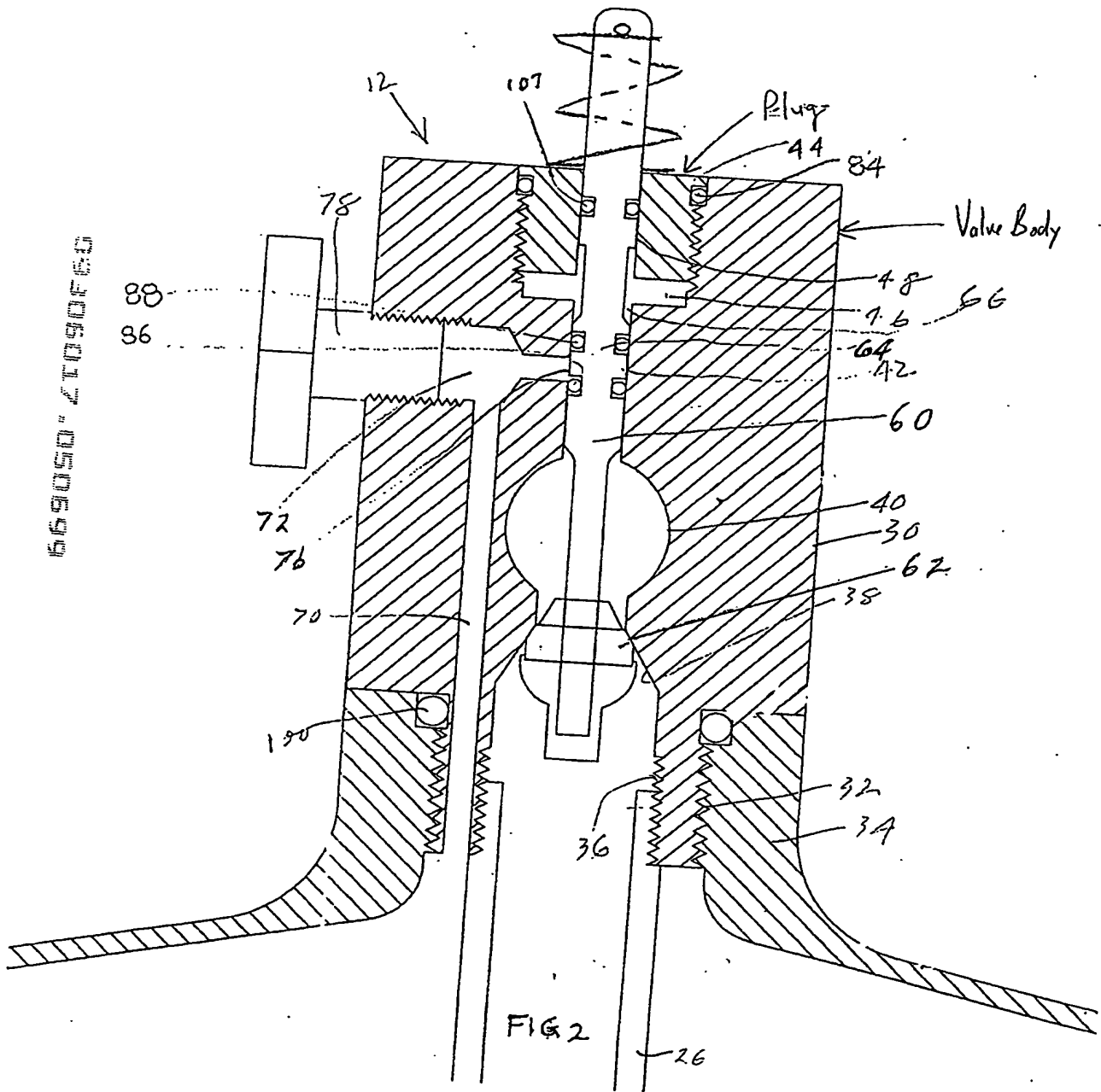
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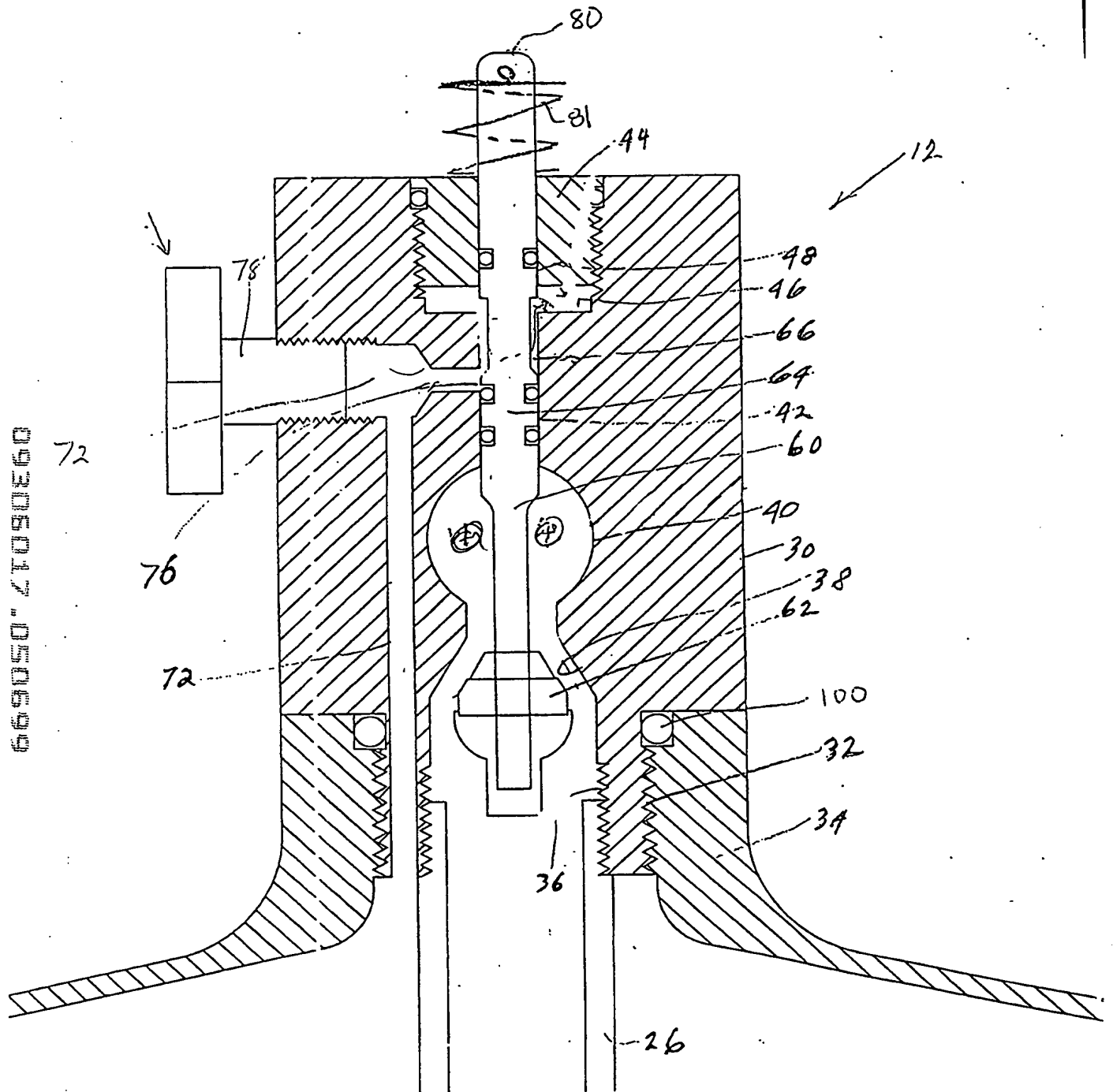


Fig 3

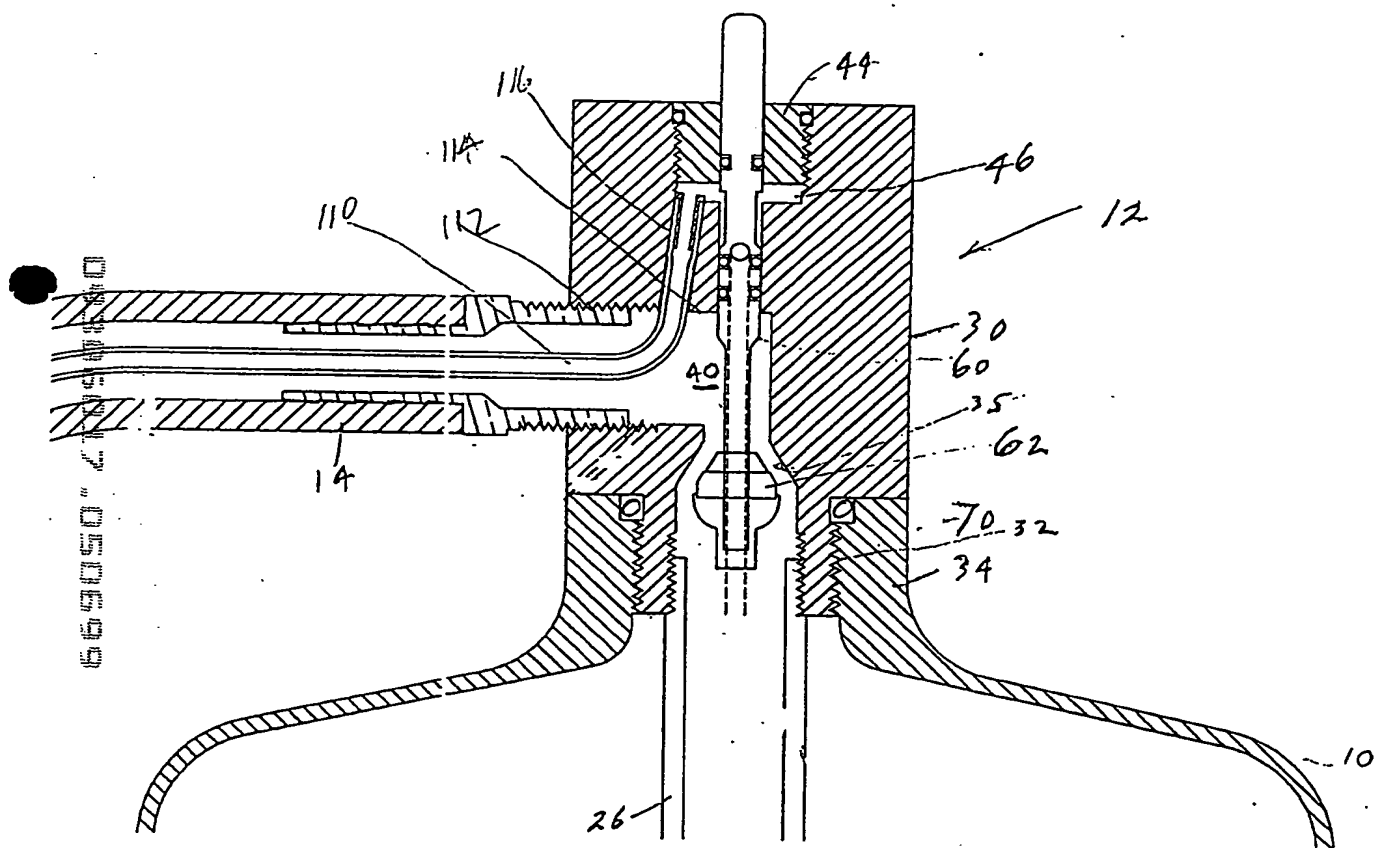


Fig. 4

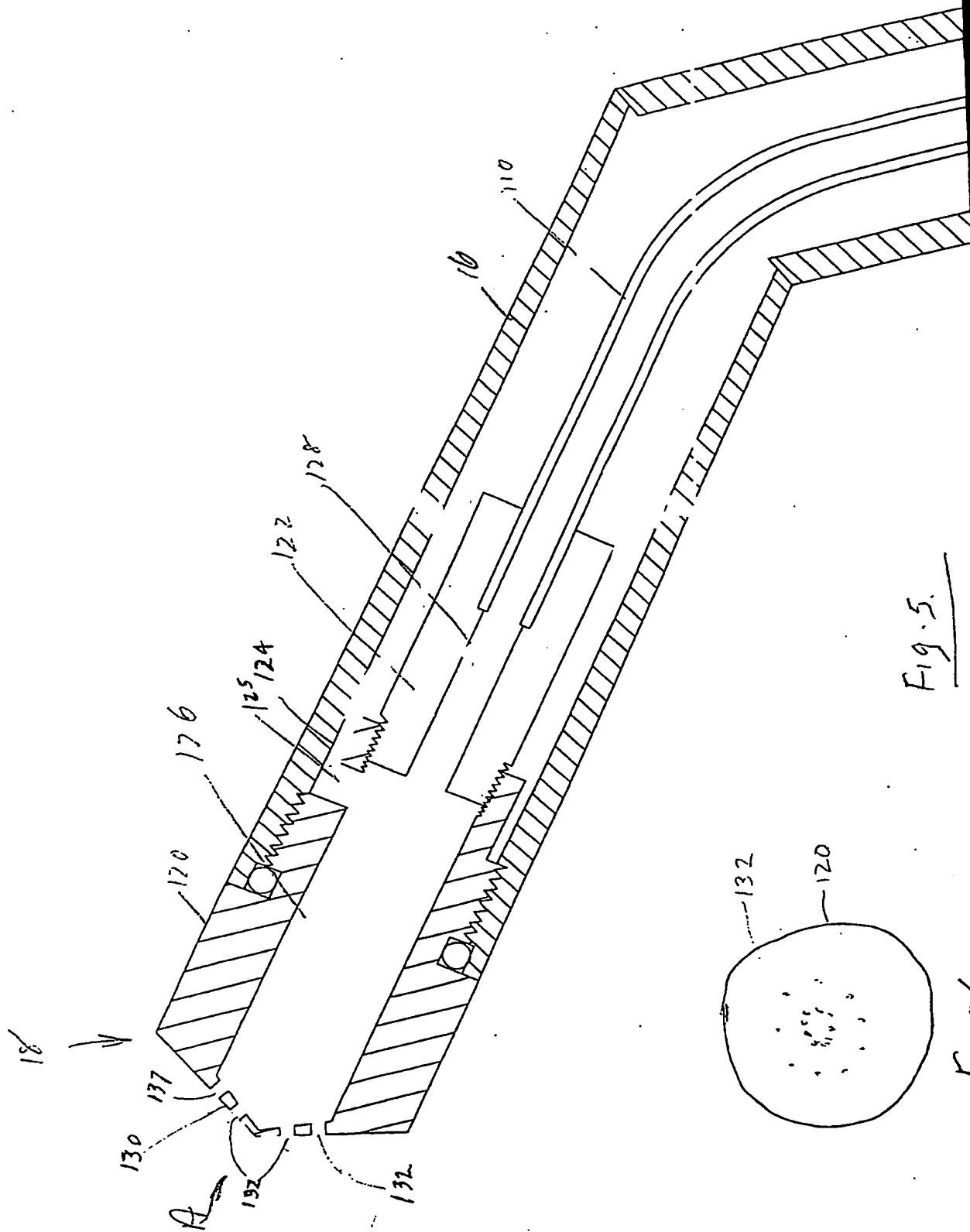


Fig. 5.

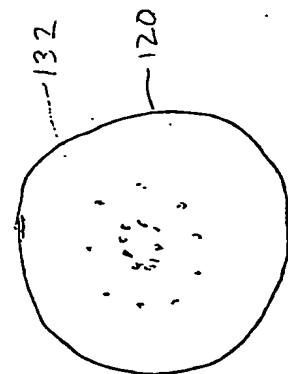
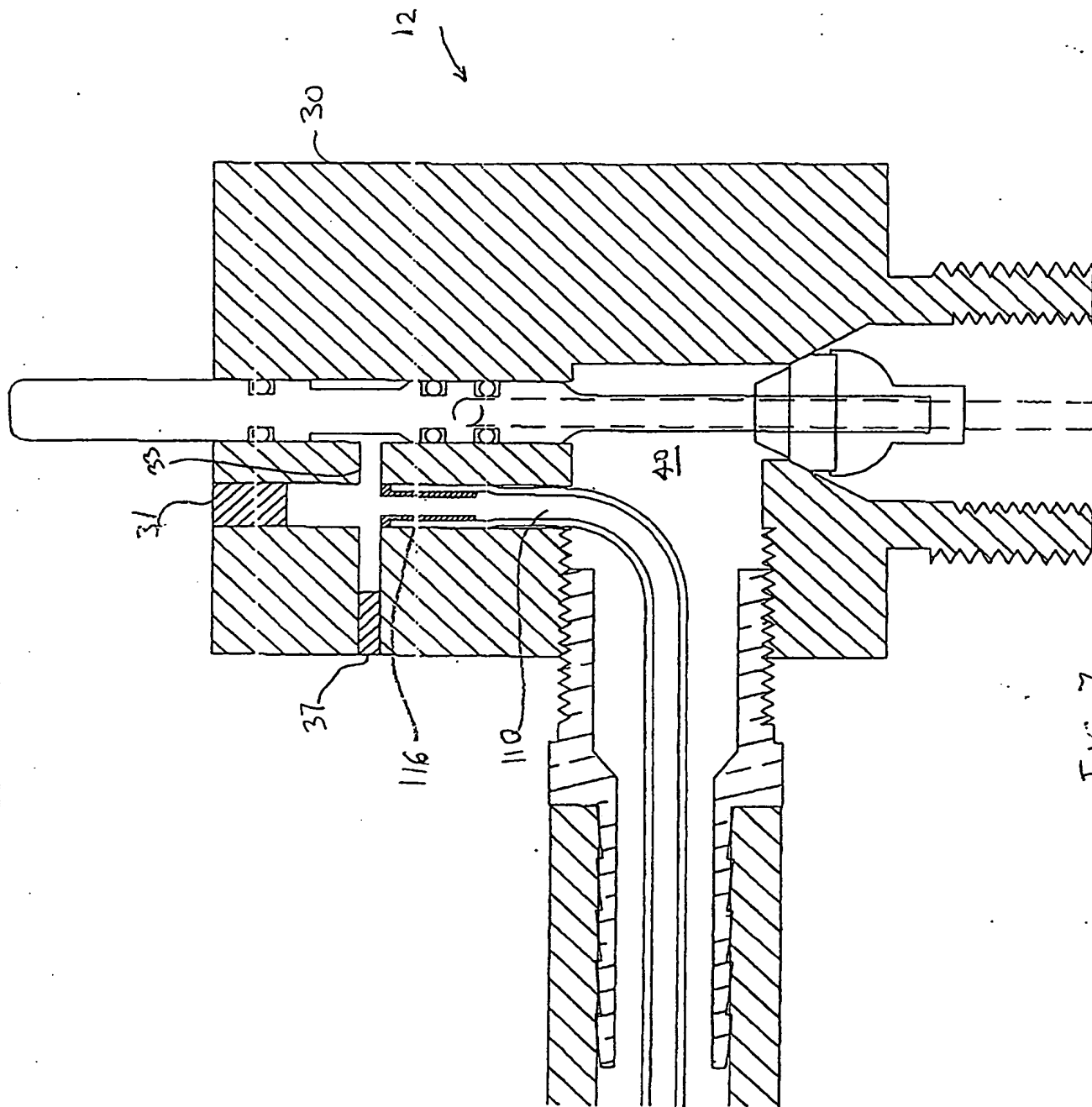


Fig. 6

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